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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/726,328	12/01/2003	Garro J. Derderian	MI22-2297	3662
21567	7590	06/26/2006	EXAMINER	
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			SUCH, MATTHEW W	
			ART UNIT	PAPER NUMBER
			2891	

DATE MAILED: 06/26/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/726,328

Applicant(s)

DERDERIAN ET AL.

Examiner

Matthew W. Such

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-60 is/are pending in the application.
- 4a) Of the above claim(s) 1-31, 34-38 and 49-60 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 32, 33 and 39-48 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 December 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 1 December 2003, 12-31-03
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group IC, drawn to claims 32-33 and 39-48, in the reply filed on 13 June 2006 is acknowledged.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: "32" (see Paragraph 32 of applicant's disclosure).
3. The drawings are objected to because the label "16" does not appear in Fig. 6.
4. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 32-33, 44-45 and 48 are rejected under 35 U.S.C. 102(b) as being anticipated by Raaijmakers ('387).

a. Regarding claim 32, Raaijmakers teaches a method for forming a particle-impregnated conductive material over a semiconductor substrate (Element 20, 32).

Particles (Elements 48, 52, 304) are spread over the semiconductor substrate (Element 20, 32).

A monolayer of conductive electrode material (Paragraphs 0100-0103, 0139-140; Elements 46, 310) is formed over the particles forming at least part of a particle-impregnated material (Fig. 3). The manner in which the claim is written does not limit the number of monolayers formed over the particles, nor the position relative to the particle location as long as they are over, nor the length of time the monolayer remains.

b. Regarding claim 33, Raaijmakers further teaches that the particles (Elements 48, 52, 304) are an electrically conductive electrode (Paragraph 0012, 0088).

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- c. Regarding claim 44, Raaijmakers further teaches that the particles have a size of about 50-750 Angstroms (5-75 nanometers), which is within the claimed range of 100-10,000 Angstroms (Paragraph 0012).
- d. Regarding claim 45, Raaijmakers further teaches that the monolayer comprises tungsten (Paragraph 0139-140).
- e. Regarding claim 48, Raaijmakers teaches that the monolayer comprises tantalum (Paragraphs 0100-0103).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 39-42 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers ('387) in view of Lee (824).

- a. Regarding claim 39, Raaijmakers teaches using silicon as the particles in capacitor structures (Paragraph 0010 and 0012). Raaijmakers teaches that silicon nitride is used as a barrier layer protecting the silicon particles from oxidation, but admits that

the silicon nitride layer is incorporated into the dielectric, lowering the effective dielectric constant. Raaijmakers does not teach using tungsten for the particles.

Lee teaches that the particles comprise tungsten (Col. 5, Lines 45-48). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use tungsten as the particles as taught by Lee in the methods of Raaijmakers in order to maintain a high dielectric constant in dielectric film (Lee Col. 5, Lines 49-52). Lee teaches that a refractory metal such as tungsten can be used as particles to avoid nitridation of the dielectric layers and maintain a higher dielectric constant (Col. 3, Lines 25-41).

b. Regarding claim 40, Raaijmakers further teaches that the monolayer comprises tungsten (Paragraph 0139-140).

c. Regarding claim 41, Raaijmakers teaches using silicon as the particles in capacitor structures (Paragraph 0010 and 0012). Raaijmakers teaches that silicon nitride is used as a barrier layer protecting the silicon particles from oxidation, but admits that the silicon nitride layer is incorporated into the dielectric, lowering the effective dielectric constant. Raaijmakers does not teach using tungsten for the particles.

Lee teaches that the particles comprise tungsten silicide (Col. 5, Lines 45-48). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use tungsten as the particles as taught by Lee in the methods of Raaijmakers in order to maintain a high dielectric constant in dielectric film (Lee Col. 5, Lines 49-52).

Lee teaches that a refractory metal silicide such as tungsten silicide can be used as particles to avoid nitridation of the dielectric layers and maintain a higher dielectric constant (Col. 3, Lines 25-41).

d. Regarding claim 42, Raaijmakers further teaches that the monolayer comprises tantalum (Paragraphs 0100-0103).

e. Regarding claim 46, Raaijmakers teaches that the monolayer comprises tungsten (Paragraph 0139-140). Raaijmakers also teaches that monolayer metals, can be exposed to a silane to incorporate silicon in the layer (Paragraphs 0064-0069). Raaijmakers does not forming tungsten silicide.

Lee teaches using metal silicides, such as tungsten silicide as an upper electrode along with using SiH_4 , Si_2H_6 , and SiH_2F source gases during deposition. It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a metal silicide, such as tungsten silicide, as taught by Lee in place of the tungsten used by Raaijmakers. Tungsten and tungsten silicide are functionally equivalent in terms of an ability to act as diffusion barriers to keep, for example, silicon out of the dielectric and prevent dielectric degradation of the capacitor system during processing (Lee Col. 7, Lines 45-56). It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

f. Regarding claim 47, Raaijmakers further teaches forming a tungsten monolayer with WF₆ (Paragraph 0140).

9. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Raaijmakers ('387) in view of Lee ('824) as applied to claim 42 above, and further in view of Kim ('487).

Raaijmakers in view of Lee teach that the monolayer comprises tantalum (Raaijmakers Paragraphs 0100-0103; Lee Col. 7, Lines 32-44). More specifically, the tantalum comprising film can be a Ta₂O₅ dielectric film. Although Raaijmakers in view of Lee teach various alternatives to Ta₂O₅, neither explicitly discloses tantalum nitride.

Kim teaches using a tantalum comprising monolayer, such as Ta₂O₅, as a dielectric material. Kim teaches a variety of alternative materials for the monolayer, such as tantalum nitride (Col. 8, Lines 26-39).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use tantalum nitride as the monolayer as suggested by Kim in the methods described by Raaijmakers in view of Lee. Lee teaches that tantalum nitride is functionally equivalent to Ta₂O₅ in terms of dielectric properties. It has been held to be within the general

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skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945) See also *In re Leshin*, 227 F.2d 197, 125 USPQ 416 (CCPA 1960). MPEP § 2144.07.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- i. Black ('364) and Uda ('024) each teach various methods for forming layers containing nanoparticles, for example that contain tungsten.
- ii. Chung ('183) teaches various methods to form silicides and nitrides.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew W. Such whose telephone number is 571-272-8895. The examiner can normally be reached on Monday - Friday 8AM-5PM EST.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bradley W. Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Matthew W. Such
Examiner
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MWS
6/19/06



B. WILLIAM BAUMEISTER
SUPERVISORY PATENT EXAMINER